



## TITLE OF THE INVENTION

### Hybrid Hot Air Heater

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a hybrid hot air heater incorporating a gas heater and an electric heater into one chassis.

### 2. Description of the Related Art

This type of conventional hybrid hot air heater as disclosed in, for example, Jpn. Pat. Appln. KOKAI Publication No. 2000-9347 is already known. In this conventional hybrid hot-air heater, a combustion heater and an electric heater are incorporated into a chassis such that an air-blowing system is constituted by one air-blowing fan. If, in this configuration, the air-blowing system for the combustion heater and that for the electric heater are controlled by one air-blowing fan, the generated heat quantity will be different compared to when the electric heater is operated together with the combustion heater and when the combustion heater is operated alone with the electric heater not operating. This makes it necessary for different quantities of intake air to be blown into the chassis in these different cases to prevent overheating thereby making it difficult to operate the combustion heater with stability because of differences in the quantity of combusted air.

To solve this problem, an approach that was considered is one in which the combustion heater unit and the electric heater unit are arranged one over the other and each provided with an air-blowing fan as well as an inlet and an outlet in such a configuration that their air-blowing systems may be independent of each other. The inlet

is mounted with an anti-dust filter to prevent dust and dirt from accumulating into the chassis of the heater.

However, if an anti-dust filter is mounted to the inlet, the quantity of air sucked into the chassis when the air-blowing fan is driven will be decreased. Therefore, to blow out a sufficient quantity of hot air from the outlet through each of the air-blowing fans, it is necessary to increase the cross-sectional area of the inlet.

However, if an inlet having a larger cross-sectional area is formed on the rear face facing toward both of the combustion heater unit and the electric heater unit, the height of the heater itself will be increased making it more difficult to use thereby creating a problem.

In view of the above problems, it is an object of the present invention to provide a hybrid hot air heater such that the heater itself is compact and easy to use.

#### **SUMMARY OF THE INVENTION**

To solve the above problems, a hybrid hot air heater according to the present invention comprises a chassis having first and second outlets on its front face and first and second inlets on its rear face. These are configured such that a gas heater unit comprised of a gas burner and a first air-blowing fan arranged below the gas burner that mixes combustion gas sent from the gas burner and air taken into the chassis through the first inlet and blows it out through the first outlet to the room is incorporated into the chassis at its upper part. An electric heater unit comprised of an electric heater that heats air taken in through the second inlet and a second air-blowing fan that blows out the heated air through the second outlet into the room is incorporated into the chassis at its lower part in such a manner that air-blowing systems of the respective heater units may

be independent of each other, wherein the second inlet is formed to conserve space and serve as an air inlet passage on a rear side of the housing of the first air-blowing fan that separates these heater units from each other.

According to the present invention, part of the chassis positioned on the rear side of the housing of the first air-blowing fan is used as an inlet for the electric heater unit in order that an increase in the cross-sectional area of this inlet does not increase the height of the heater itself.

It is to be noted that the first and second outlets may be formed adjacent to each other vertically such that air blown out from the first air-blowing fan and air blown out from the second air-blowing fan flow into each other.

However, if hot air is blown out from the second outlet in the electric heater unit arranged at the lower part, the hot air may overheat the floor of the room. Therefore, it is preferable for a fan duct leading to the second outlet formed in the housing of the second air-blowing fan to be arranged facing upward.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is an explanatory front view of a configuration of a hybrid hot air heater according to the present invention; and

FIG. 2 is an explanatory vertical cross-sectional view of the configuration of the hybrid hot air heater according to the present invention.

#### **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

As shown in FIGS. 1 and 2, reference number 1 indicates a hybrid hot air heater according to the present invention. This hot air heater 1 has a box-shaped chassis 11. In

the chassis 11, a gas heater unit 2 and an electric heater unit 3 are incorporated at the upper part and the lower part, respectively.

According to the present embodiment, a first outlet 12a and a second outlet 12b are formed on the front face of the chassis 11 and a first inlet 13a and a second inlet 13b are formed on the rear face of the chassis 11 in such a manner that they may stand against the gas heater unit 2 and the electric heater unit 3, respectively. Here, as described later, two air-blowing fans are used to make air-blowing systems for the respective gas heater unit 2 and electric heater unit 3 independent of each other.

The gas heater unit 2 comprises a gas burner 20 serving as a combustor and a first air-blowing fan 21 arranged below the gas burner 20 to supply it with combustion air. Fan 21 further mixes combusted gas and air that is sucked into the chassis 11 through the first inlet 13a and then blows out a mixture to the room.

The gas burner 20 is an all-primary combustion burner and has a burner body 20a including a fuel/air inlet 201 formed in the proximity of a gas spray nozzle 42 arranged at a tip of a gas tube (not shown) connected to a proportional valve 41 arranged in the chassis 11 and a mixer tube 202 that communicates with this inlet 201. A ceramic burner port plate 204 having a plurality of burner ports formed in it in a row is mounted to the opened upper face of the burner body 20a via a distribution plate 203 and is also covered above by a combustion cover 205.

In the chassis 11, a first partition 5a is provided in such a manner as to cover from above the combustion chamber 206 of the gas burner 20 covered by the combustion cover 205. Further, a second partition 5b is provided in the chassis 11 such that the gas burner 20 as well as the first partition 5a may be covered and an air passage 51 leading to

the first air-blown fan 4 may be formed between itself and the first partition 5a. The first air-blown fan 21 arranged below the burner body 20a has a housing 211 in which a fan duct 211a leading to the first outlet 12a is formed.

A cross-flow type first moving vane 213 is arranged in the housing 211 and is connected to a first motor 212 whose rotation speed can be controlled. In this configuration, the air passage 51 and an internal space of the housing 211 communicate with each other through an upper face opening 211b formed in the housing 211.

Thus, the air-blowing system for the gas heater unit 2 is formed in such a manner leading from the first inlet 13a to the first outlet 12a. In this configuration, when the first motor 212 is driven to rotate the first moving vane 213, room air is taken into the chassis 11 through the inlet 13a and supplied to the inlet 201 in the burner body 20a as well as also through the air passage 51.

For this case, mixed air is supplied to the burner port plate 204 when combustion gas is sprayed into the inlet 201 through the gas spray nozzle 42. It is to be noted that the air/fuel ratio can be adjusted by controlling the first motor 212 to regulate the rotation speed of the first moving vane 213.

Combusted gas from the gas burner passes through the inside of the first partition 5a and is sucked toward the first air-blown fan 21. Further the air taken in through the first inlet 13a flows to the end of the first partition 5a through the air passage 51 whereupon the combusted gas and the air are mixed and cooled and then flow into the housing 211 through an opening 211b. Then, a mixed gas having a predetermined temperature is released into the room through the outlet 12a.

The electric heater unit 3, on the other hand, has a second air-blowing fan 30 that communicates with the second inlet 13b. This second air-blowing fan 30 has a housing 301 in which a fan duct 301a leading to the outlet 12b is formed. A housing with a cross-flow type second rotation vane 32 connected to a second motor 31 whose rotation speed can be controlled is arranged here. Further, the fan duct 301a is provided with eight seed heaters 33.

Thus, an air-blowing system for the electric heater unit 3 is formed in such a manner leading from the second inlet 13b to the second outlet 12b. In this configuration, when the second motor 31 is driven to rotate the second moving vane 32, room air is taken in through the inlet 13b. This air is heated as it passes through the seed heater 33 provided on the fan duct 301a and is then released into the room through the outlet 12b.

It is to be noted that the outlets 12a and 12b are formed adjacent to each other such that hot air blown out by the first air-blowing fan 21 and hot air blown out by the second air-blowing fan 30 may flow into each other.

It is also to be noted that the first and second inlets 13a and 13b are mounted with anti-dust filters 6a and 6b, respectively, to prevent dust and dirt from accumulating in the chassis 11. These anti-dust filters 6a and 6b act as a hindrance to decreases in the quantity of air taken into the housings 211 and 301 when the first and second air-blowing fans 21 and 30 are driven, respectively.

Therefore, it is preferable to make the cross-sectional areas of each of the first and second inlets 13a and 13b larger in order to obtain a sufficient quantity of hot air blown out from each of the first and second outlets 12a and 12b. However, if an inlet

having a large cross-sectional area is formed on the rear face of the chassis 11 facing the gas heater unit 2 and the electric heater unit 3, the height of the heater itself will increase.

In the present embodiment, the second inlet 13b is formed to conserve space. This inlet serves as an air inlet passage on a rear side of the housing 211 of the first air-blowing fan 21 that separates the air-blowing system of the gas heater unit 2 and the electric heater unit 3 from each other. Thus, even if the cross-sectional area of the second inlet 13b of the electric heater unit 3 is increased, the height of the heater itself will not increase.

Further, hot air, when blown out from the second outlet 12b of the electric heater unit 3, may overheat the floor of the room. Therefore, the fan duct 301a of the second air-blowing fan 30 is inclined upward.